WHAT IS CLAIMED IS:

1. A method for determining temperature of a transducer of an ultrasonic hand piece; comprising the steps of:

determining a shunt capacitance of the transducer;

calculating the temperature of the transducer based on the shunt capacitance of the transducer; and

providing a warning to a user of the hand piece if one of the temperature of the transducer and a rate of change of the temperature is excessive.

2. The method of claim 1, wherein said determining step comprising the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring shunt capacitances of the transducer at frequencies across the predefined frequency range;

comparing the measured shunt capacitances;

determining whether any measured shunt capacitance varies by more than a predetermined value for all measured shunt capacitances; and

averaging the measured shunt capacitances and calculating the transducer temperature.

3. The method of claim 2, further comprising the step of:

filtering the measured shunt capacitances.

4. The method of claim 3, wherein said filtering comprises the steps of:

discarding invalid measured shunt capacitance values which vary by greater than the predetermined value; and

determining whether a number of remaining measured shunt capacitance values is greater than a pre-defined number; and

returning to the step of measuring shunt capacitances of the transducer, if the number of remaining measured shunt capacitance values is less than the pre-defined number.

5. The method of claim 4, wherein the pre-defined number is 3.

6. The method of claim 2, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

7. The method of claim 2, wherein the pre-defined frequency range is set such that non-resonant frequencies are located in the predefined frequency range.

8. The method of claim 2, wherein said measuring step comprises the step of:

measuring shunt capacitances at several different frequencies within and spaced along the predefined frequency range.

9. The method of claim 8, wherein the shunt capacitances are measured at five different frequencies.

10. The method of claim 2, wherein the pre-determined value is approximately 10 percent.

11. The method of claim 2, wherein the calculation is performed in accordance with the relationship:

$$\Delta C_0 = C_s - C_0 ,$$

where C_s is the capacitance at an off-resonance frequency which is stored in memory and C_0 is the shunt capacitance.

12. The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring the hand piece impedance;

determining whether the hand piece phase difference is less than a predetermined value;

measuring the hand piece impedance a pre-established number of times;

computing a hand piece average shunt capacitance;

incrementing the drive signal by a set frequency value;

determining whether one of the drive frequency is greater than a pre-set frequency and a number of impedance measurements is less than a pre-defined number; and

computing an average shunt capacitance value at each drive frequency.

13. The method of claim 12, further comprising the step of:

incrementing the drive signal by the set frequency value, if the absolute value of the hand piece phase difference is greater than the predetermined value; and

returning to the step of measuring the hand piece impedance.

14. The method of claim 13, wherein the set frequency value is 25 Hz and the predetermined value is 89.5°.

15. The method of claim 12, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

16. The method of claim 12, further comprising the step of:

performing a calculation to determine whether the hand piece is within acceptable temperature limits; and

providing a warning, if the transducer temperature is not within acceptable limits.

17. The method of claim 16, wherein the calculation is performed in accordance with the relationship:

$$\Delta C_0 = C_s - C_0 ,$$

where C_s is the capacitance at an off-resonance frequency which is stored in memory and C_0 is the shunt capacitance.

18. The method of claim 12, wherein the pre-established number is 10 percent.

19. The method of claim 12, wherein the average shunt capacitance is computed in accordance with the relationship:

$$C_0 = \frac{1}{2\pi f |Z_{HP}|} ,$$

where f is the drive frequency of the generator, and Z_{HP} is the hand piece impedance.

20. The method of claim 12, wherein the pre-set frequency is 44.5 kHz and the pre-defined number is 100.

21. The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the hand piece/blade across a pre-defined frequency range;

measuring a first hand piece shunt capacitance when a user first activates the hand piece/blade;

measuring a second hand piece/blade shunt capacitance when the surgeon deactivates the hand piece/blade;

calculating a time difference between when the hand piece/blade is activated and deactivated using a time when the first measured hand piece/blade shunt capacitance is obtained and a time when the second measured hand piece/blade shunt capacitance is obtained;

computing a rate of change value of the hand piece/blade shunt capacitance using the calculated time difference;

determining whether the rate of change value of the hand piece/blade shunt capacitance is greater than a predetermined threshold above a value stored in memory; and

providing a warning to the user, if the rate of change value of the hand piece/blade shunt capacitance is greater than the predetermined threshold above the value stored in memory.

22. The method of claim 21, wherein the predefined frequency range is from approximately 34 kHz to 44 kHz.

23. The method of claim 21, wherein said computing step comprises the step of:

dividing a difference between the first measured hand piece/blade shunt capacitance and the second measured hand piece/blade shunt capacitance by a difference in time between when the first measured hand piece/blade shunt capacitance is obtained and when the second measured hand piece/blade shunt capacitance is obtained.

24. The method of claim 21, wherein the predetermined threshold is a shunt capacitance rate of change value stored in memory.

25. The method of claim 24, wherein the predetermined threshold is 120 pF/min.

26. The method of claim 1, wherein said determining step comprises the steps of:

applying an ultrasonic drive signal to the transducer across a pre-defined frequency range;

measuring the hand piece impedance at fixed frequency intervals to obtain a measured impedance at each frequency interval;

performing a curve fit based on each measured impedance at each frequency interval to obtain a curve fit equation;

solving the curve fit equation at equally spaced frequency values to obtain a group of distinct impedance values;

calculating a shunt capacitance based on each distinct impedance value;

discarding a maximum and a minimum calculated shunt capacitance value to obtain a residual group of shunt capacitances; and

averaging the residual group of shunt capacitances to obtain a final shunt capacitance value of the hand piece.

27. The method of claim 26, wherein the curve fit is performed in accordance with the relationship:

$$Z_{HP} = af_0^2 + bf_0 + c\,,$$

where a, b and c are constants which are calculated via the curve fit and f_0 is a fixed frequency at which the hand piece impedance is measured.

28. The method of claim 22, wherein the pre-defined frequency range is from approximately 34.5 kHz to 44.5 kHz.

29. The method of claim 26, wherein the fixed frequency interval is 50 Hz.

30. The method of claim 26, wherein the shunt capacitance is calculated in accordance with the relationship:

$$C_0 = -(1/f_0) * (Z_{HP}^2 - 1/R_p^2)^{1/2} - (C_{v1} * C_{v2})/(C_{v1} + C_{v2}) + 1/(f_0^2 * L_t) - C_c - C_{pcb},$$

where C_o is the shunt capacitance, f_0 is a fixed frequency at which the hand piece impedance is measured, Z_{HP} is the hand piece impedance at the fixed frequency f_0, R_p is a value of a limiting resistor, C_{v1} and C_{v2} are values of voltage dividing capacitors, L_t is a value stored in memory of the generator which represents a transducer tuning inductor, C_c is a capacitance of a hand piece cable and C_{pcb} is a contribution of capacitance from a printed circuit board in the generator.

31. The method of claim 26, wherein the group of distinct impedance values comprises eleven impedance values.

32. The method of claim 26, wherein the equally spaced frequency values are spaced apart at 1000 Hz intervals.